2.2.3.2 Overload of Airborne AMS(R)S/Inmarsat Terminals

The possibility of an airborne AMS(R)S/Inmarsat terminal being overloaded by ATC base stations was also evaluated. The analysis of potential saturation of airborne Inmarsat terminals assumes, again, a conservative 1000 base stations being visible from a 302 m (1000 ft.) altitude.

Table 2.2.3.2.A Evaluation of Potential for AMS(R)S Airborne Terminal Overload

Parameter	Units	MSV Value	Our Analysis
BS EIRP per carrier	(dBW)	19.1	19.1
Carriers per sector	(#)	3.0	3.0
Voice activation	(dB)	4.0	4.0
BS Power Control	(dB)	6.0	5.2
EIRP per sector	(dBW)	13.9	14.7
Polarization Isolation	(dB)	8.0	0.0
Gain Discrimination MES to Base Station	(dB)	0.0	0.0
Loss Factor from OOB analysis	(dB)	-101.6	-105.1
Effective power per Sector @ A/C	(dBW)	-95.7	**-90.4**
Power at A/C Receiver	(dBm)	-65.7[128]	-60.4
Overload Level	(dBm)	-50.0	-50.0
Margin	(dB)	15.7	10.4

The analysis shown in Table 2.2.3.2.A indicates that there exists a margin of 10 dB against receiver overload or saturation. Additionally, as indicated for the out-of-band case, as the altitude of the aircraft is increased, for example to 5000 ft, the margin against overload increases dramatically by approximately 9 dB to a total margin of 19 dB. Given the conservative nature of the model (e.g. antenna models, 1000 base stations, very low aircraft altitude, omnidirectional aircraft antenna. and no terrain shielding), overload from ATC base stations should not be an issue.

3.0 Inter-Service Interference Analyses

Several services are allocated in and adjacent to the 1525-1559 MHz and 1626.5-1660.5 MHz L-band MSS spectrum. Within the 1626.5-1660.5 MHz and 1525-1559 MHz bands, the Aeronautical Mobile Satellite, en-route Service (AMS(R)S), aeronautical terrestrial service, and Global Maritime Distress and Safety System (GMDSS) are allocated spectrum. Above 1660 MHz, the Radio Astronomy Service is allocated spectrum in the L-band. Within the 1525-1559 MHz band, Search and Rescue Satellite (SARSAT) downlinks operate in the 1544-1545 MHz band. Systems operate adjacent to the L-band spectrum as well. Below the 1626.5 MHz band, Big LEO MSS systems operate in the MSS allocation from 1610-1626.5MHz. Below the 1525 MHz band edge, Mobile Aeronautical Telemetry systems operate in the 1435-1525 MHz allocation. Above the 1559 MHz band edge, GPS operations in the 1559-1610MHz Radionavigation Satellite Service (RNSS) allocation. Figure 3.0.A is provided to show the various service allocations located adjacent to and within the L-band MSS allocations where MSV proposes to operate its ATC system.

[128] MSV actually calculates this value as –60.7 dB. See MSV Jan. 10,2002 *Ex Parte* Letter at 28 .

radio frequency transmitters.[141] The ITU has conducted studies and recommended appropriate protection requirements for RAS stations.[142] Consistent with the ITU studies, ATC operators could be required to take all practicable steps to avoid interference to United States RAS observations in the 1660-1660.5 MHz band, consistent with Recommendation ITU-R RA.769-1 of the international Radio Regulations.

3 3 Systems Operating within the 1525-1559 MHz Band Portion of the L-Band Spectrum

Search and Rescue Satellite (SARSAT) downlink operations exist in the 1544-1545 MHz band in accordance with Footnote 5.356 of the International Radio Regulations.[143] SARSAT uplink transmissions are located around 406 MHz from Emergency Position Indicator Radio Beacon (EPIRB) transmitters that are downlinked in the 1544-1545 MHz band to various earth station receivers located in the United States. The locations of these Earth stations are listed below in Table 3.3.A.

Table 33.A: Locations of SARSAT Receive Earth Stations

Location	Latitude	Longitude	Nearby Local
Alaska	64.9933 N	-141.5231 E	Fairbanks
California	34.6624 N	-120.5514 W	Vandenberg AFB
Florida*[144]	**TBD**	**TBD**	**TBD**
Guam	13.5783 N	144.9391 W	Guam
Hawaii	21.526 N	-157.9964 W	Oahu
Maryland	38.9955 N	-76.8513 W	NASA GSFC
Maryland	38.8510 N	-76.9310 W	Suitland
Puerto Rico**	18.4317 N500	-66.1922 W	Puerto Rico
Texas**	29.5605 N1	-95.0925 W	NASA Huston

143

130 *See, e.g., Application of AMSC Subsidiary Corporation for a Blanket License to Construct and Operate*

stations operating in bands adjacent to the receiving SARSAT earth stations. We base our analysis on the MSV ATC base stations being capable of meeting an out-of-band emission level of -57.9 dBW/MHz as in our other interference analyses.

Table 33.B: Analysis of SARSAT Avoidance Distance

Item	Units	Value	Comment
Nominal Center Frequency	(MHz)	1554.5	
Polarization			Note I
Elevation Angle	(Degrees)	0	Note 2
Antenna Diameter	(m)	1.8	
SARSAT Gain (typical)	(dBi)	26.1	
SARSAT (G/T)	(dB/K)	4.0	
SARSAT Noise Temperature	(dBK)	22.1	
Receiver Noise Power	(dBW/Hz)	-205.9	
Allowable I/N	(dB)	-11.32	
Maximum Allowable Io	(dBW/Hz)	-217.2	
Receive Gain	(dBi)	26.7	
Isotropic Area	(dBm^2)	-25.3	
Receive Antenna Effective Area	(dBm^2)	1.5	
Allowable Power Flux at Antenna	(dBW/m^2 Hz)	-218.6	
MSV OOB Emission	(dBW/MHz)	-57.9	
MSV BS peak Antenna gain	dBi	16.0	
BS Gain Reduction Toward Horizon	dB	5.0	
Three BS Carriers	dB	4.8	
Power Control	dB	-2.3	
Voice Activation	dB	-1.8	
Polarization Discrimination	dB	0	
Peak Out-of-band Emission	dBW/MHz	-49.1	
MSV OOB Emission Density	(dBW/Hz)	-109.1	
Required Loss	(dBm^2)	134.8	
Maximum Interference Distance	(km)	85.6	
Maximum Interference Distance	(mi)	51.4	

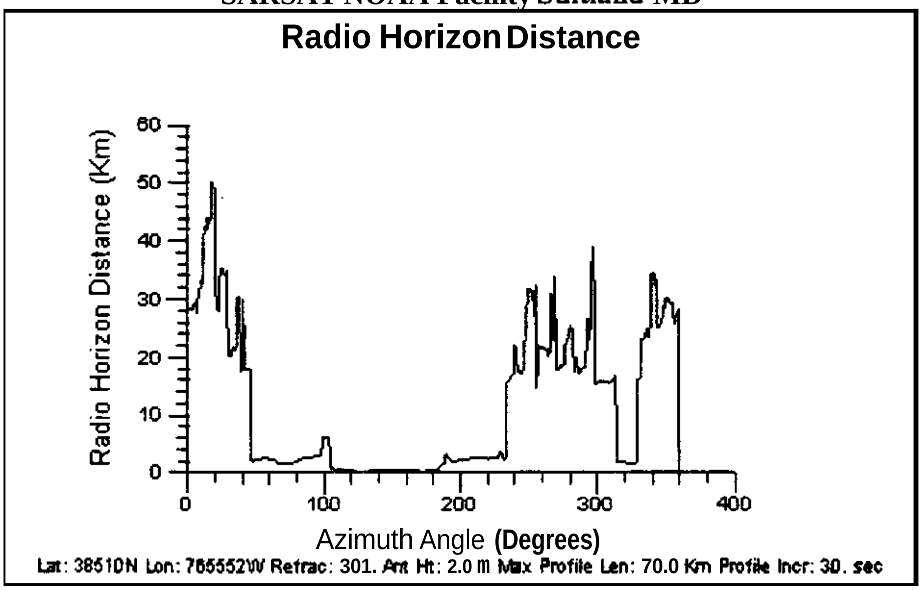
Note 1: SARSAT Svstem uses both R] `P and LHCP
Note 2 SARSAT receivers typically point to the horizon awaiting an oncoming NGSO satellite.

As calculated in Table 3.3.B, if the ATC base station is located more than 85.6 km from the SARSAT receivers, interference is not expected to occur. This is based on the worst case scenario of the main-beam coupling between the SARSAT receive antenna and the ATC base station transmitting antenna using free-space loss. Path profiling (i.e. selecting locations for ATC base stations where main-beam coupling would be less likely to occur) would further reduce this distance.

NTIA has analyzed the same situation and come to the conclusion that an ATC BS within 30 km of a SARSAT station should be coordinated.[145] The approach used by NTIA assumed a number of additional technical factors, including: *15%* of the interference budget of the SARSAT system was devoted to ATC and an irregular terrain model (ITM) was used to determine coordination distance.[146] The NTIA analysis shows that a coordination distance of 27 km is necessary. We choose to use a 27 km coordination distance.

The following figures show the distance to the radio-horizon for the two SARSAT stations located in the Washington, D.C. area.[147] While the radio-horizon extends beyond the distance calculated in Table 3.3.B along some azimuths, in general, it is much closer than the maximum interference distance. This should make coordination of the BS and SARSAT operations possible at distances much less than 27 km in many cases.

Figure 33.A Distance to Horizon for SARSAT NOAA Facility Suitland MD



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145 *See* NTIA Nov. 12,2002 *Ex Pane* Letter, Encl. *5.*

146 The Institute for Telecommunication Science Irregular Terrain Model (ITM). For additional information, *see* NTIA Report 82-100, *A guide to the Use of ITS Irregular Terrain Model in the Area Prediction Mode* (April, 1982).

147 These figures were generated using the software package "HORIZON available from the NTIA Microcomputer Spectrum Analysis Models webpage http://ntiacsd.ntia.doc.gov/msam/.

the local phone cell. Because of the possible close proximity of the MSV base station transmit antenna to a cellular time-base receiver of another system, particularly if they are on the same tower, MSV should take necessary steps to avoid causing interference to receive equipment occupying the same tower.

3.5 Systems Operating Adjacent to the 1525-1559 MHz Portion of the L-Band

Mobile Aeronautical Telemetry (MAT). Mobile Aeronautical Telemetry (MAT) systems operate below 1525 MHz. The Aerospace & Flight Test Radio Coordinating Council (AFTRCC) is concerned about the potential for interference that MSV ATC base stations could cause to MAT operations adjacent to the L-band. MSV asserts that, under the worst case scenario, there would be no interference to a MAT receiver from an ATC base station if the ATC base station is located at least 0.9 km from the MAT receiver.'"[149] We have evaluated MSV's calculations and agree with the assumptions and results of MSV's analysis. However, the proper coordination distance for this case should be based on radio line of sight. MSS operators should take all practicable steps to avoid locating ATC base stations within radio line of sight of MAT receive sites in order to protect United States MAT systems consistent with Recommendation ITU-R M.1459. MSS ATC base stations located within radio line of sight of a MAT receiver must be coordinated with AFTRCC for non-Government MAT receivers on a case-by-case basis prior to operation. For government MAT receivers, the licensee will supply sufficient information to the Commission to allow coordination to take place. A listing of current and planned MAT receiver sites can be obtained from AFTRCC for non-Government sites and through the FCC's IRAC Liaison for Government MAT receiver sites.

Global Positioning System *(GPS).* The Global Positioning System operates above 1559 MHz. MSV demonstrates in its comments that its ATC base stations will be capable of meeting the -70 dBW/MHz and -80 dBW for discrete spurious emissions measured in 700 Hz, which is required of other radio transmitters operating near the spectrum used by GPS.[150] Based on MSV's proposal to operate its ATC base stations with a transmit power of 23 dBW EIRP per sector, and 1.2 MHz of frequency separation between the ATC base station and the GPS band, MSV's equipment manufacturer, Ericsson, is committed to meeting the out-of-band emission attenuation requirements. Based on the information provided by MSV, it appears that MSV's base stations will be capable of meeting the -70 dBW/MHz (and -80 dBW for discrete spurious emissions) out-of-band emission levels in the RNSS allocation as required by other transmitters currently operating in frequency bands adjacent to GPS operations. This conclusion is supported by an *ex parte* agreement that was submitted to the FCC, jointly, by the GPS Industry Council and MSV on July 17,2002.

The MSV/GPS Industry Council agreement specifies that the MSV ATC base stations will "[u]se filtering to achieve -100 dBW/MHz, or lower" emissions in the [1559-1605 MHz] frequency band. Also, the ex pane filing states that the ATC Terminals will "[u]se filtering to achieve -90 dBW/MHz, or lower, in [the] short-term" and will 'migrate to -95 dBW/MHz, or lower, for new terminals in 5 years (from the date MSV service is operational)" for emissions in the [1559-1605 MHz] frequency band. The emission limits contained in the GPS Industry Council/MSV agreement are significantly lower than those currently required for the protection of the GPS L1 signal by other radio frequency transmitters.

One scenario not specifically addressed by the MSV/GPS Industry Council agreement is that of the potential interference to GPS time-base receivers commonly used in cellular networks. These receivers are typically located on the cellular transmit towers and supply timing information to

[149] MSV Jan. 11.2002 *Ex Pone* Letter at 29

[150] *See GMPCS Order,* 7 FCC Rcd at 8936, ¶ 88.

Annex 1 to Appendix C2
MathCad Program for Evaluating Potential Saturation of Airborne MSS Receivers in the L-Band

The following examines an airborne receiver receiving potential interference from a number of ATC base stations. The base stations are distributed randomly over an area visible to the aircraft. The airborne receiver has an omnidirectional antenna of Gac. The base station has a Gbs antenna which is oriented with a angle of theta to the horizon and a random azimuth.

_______________________________ some necessary functions

$dB(x) := 10 \cdot \log(x)$ $\quad$ $r2d := \frac{180}{n}$ $\quad$ $d2r := \frac{\pi}{I80}$

$real(x) := 10^{\left(\frac{x}{10}\right)}$

$freq := 1.550$ $\quad$ $iso := dB\left[\frac{\left(\frac{0.3}{freq}\right)^2}{4 \cdot \pi}\right]$ $\quad$ $iso = -25.256$

function atan2(x,y) returns the angle *(0* to **360** degrees in radians) given x and y values

$$atan2(x,y) := \left| \begin{array}{l} ans \leftarrow \frac{\pi}{2} \cdot sign(x) \ \ \text{if } y = 0 \\ ans \leftarrow atan\left(\frac{x}{y}\right) \ \ \text{otherwise} \\ ans \leftarrow \pi \ t \ ans \ \ \text{if } y < 0 \\ ans \leftarrow 2 \cdot \pi + ans \ \ \text{if } x < 0 \wedge y > 0 \\ ans \end{array} \right.$$

Base Station Antenna Discrimination Pattern and Aircraft Gain Pattern

Base station parameters

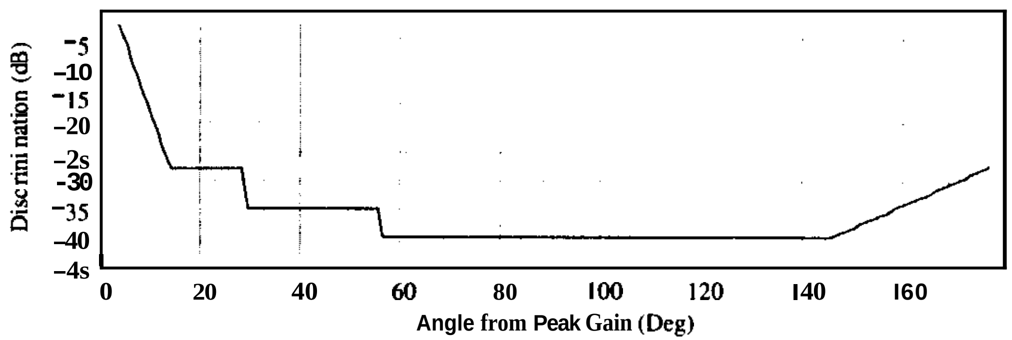
$Go := 12$ parameter used in defining antenna discrimination pattern

$e3 := 107.6 \cdot 10^{(-0.1 \cdot Go)}$ $e3 = 6.789$

$$Gbs1(\theta) := \begin{array}{|l} g \leftarrow -12\cdot\left(\frac{\theta}{\theta 3}\right)^2 \text{ if } 0 \le \theta < 4 \\ g \leftarrow -(\theta - 4)\cdot 2.5 - 4.166 \text{ if } 4 \le \theta < 13.5 \\ g \leftarrow -28 \text{ if } 13.5 \le \theta < 29 \\ g \leftarrow -35 \text{ if } 29 \le \theta < 56 \\ g \leftarrow -40 \text{ if } 56 \le \theta < 145 \\ g \leftarrow -40 + 14\cdot\frac{(\theta - 145)}{35} \text{ if } 145 \le \theta < 180 \\ g \end{array}$$

$Gbs1(0) = 0$

$\theta := 0..180$



Tilt angle of base station ant

$tilt := -5$

Aircraft Gain Patterns

$Gac1(\phi) := 0$

```
spread_cir(num, dist) := | i ← 0
                         | while i ≤ num
                         |   | xa ← (1.0 − rnd(2.0))·dist
                         |   | ya ← (1.0 − rnd(2.0))·dist
                         |   | da ← √(ya^2 + xa^2)
                         |   | if da ≤ dist
                         |   |   | az ← atan2(xa, ya)
                         |   |   | out_{i,0} ← az
                         |   |   | out_{i,1} ← da
                         |   |   | i ← i + 1
                         | out
```

Function spread–cir generates random points over a circularly shaped area and returns the distance and azimuth of the point from a central point. Distance is returned in the input units of the argument 'dist'. Az is returned in radians. 'Num" is the number of required randomly located points. This function requires the 'atan2(x,y)' function. The returned array 'spread–cir' is a two column array. The first column (subcript n,0) is the azimuth. The second (subscript n,1) is the distance. The variable 'n;' is the running index.

atten :=
$j \in 0..t$ — set loop for number of trials (t)

$um\_var \leftarrow 0$ — zero out variable to cumulate answer

'or $i \in 0..m$ — 'for loop' for number base stations in given trial

$staloc \leftarrow spread\_cir(1, mdist)$ — place BS at random distance 'staloc'(see 'spread–cir' function)

$cent \leftarrow \dfrac{staloc_{0,1}}{Re}$ — calc. geocentric angle from a/c to staloc (rad)

$dist \leftarrow \sqrt{(Re + hbs)^2 + (Re + hac)^2 - 2\cdot(Re + hbs)\cdot(Re + hac)\cdot\cos(cent)}$ — cab. distance from a/c to base station (m)

$arg \leftarrow \dfrac{Re + hac}{dist}\cdot\sin(cent)$ — calc. look angle base station ant. to a/c (rad)

$arg \leftarrow sign(arg)$ if $arg \geq 1.0$ — check for over flow of argument before taking 'acos'

$bs2ac \leftarrow acos(arg)$

$bs2ac\_tilt\_deg \leftarrow bs2ac\cdot r2d - tilt$ — cab. gain discrimination of base station antenna towards a/c taking into account antenna tilt

$bsgaindisc \leftarrow Gbs1(|bs2ac\_tilt\_deg|)$

$ac2bs \leftarrow \dfrac{\pi}{2} - bs2ac - cent$ — calc. aircraft to base station look angle (ac2bs)

$ac2bs\_ant \leftarrow \pi - ac2bs$ — assume a/c antenna is looking up and cab. off-axis angle **(ac2bs_ant=180-ac2bs)**

$ac2bs\_ant\_deg \leftarrow ac2bs\_ant\cdot r2d$

$acgain \leftarrow Gac1(|ac2bs\_ant\_deg|)$ — get gain from a/c to base station (acgain)

$ggrr \leftarrow bsgaindisc + acgain + dB\left(\dfrac{}{4\cdot\pi\cdot dist^2}\right)$ — bts to a/c gain disc x ac to bs gain x spreading loss (in dBs)

$cum\_var \leftarrow cum\_var + real(ggrr)$ — cumulate gains x loss as real values

$um_j \leftarrow dB(cum\_var) + iso$ — finished 'for loop' -convert real to dB and add isotropic antenna area to get sum of antenna gains and losses for m stations in view of aircraft

um

$Re := 6373 \cdot 1000$ Earth radius meters

$hbs := 30$ height of base station antenna in meters

$hac := \frac{1000}{5280} \cdot 1.609 \cdot 1000$ $hac = 304.735$ height of aircraft meters

$\zeta := acos\left(\frac{Re}{Re + hbs}\right)$ Central angle, base station to limb in radians

$\zeta \cdot r2d = 0.176$ degrees $\zeta \cdot \frac{Re}{1000} = 19.562$

$\xi := acos\left(\frac{Re}{Re + hac}\right)$ Central angle, radians

$\xi \cdot r2d = 0.56$ degrees $\xi \cdot \frac{Re}{1000} = 62.346$

$mdist := (\zeta + \xi) \cdot Re$

$\frac{mdist}{1000} = 81.908$ radius of area in which base stations can be seen by aircraft (km)

$\frac{mdist}{1.609 \cdot 1000} = 50.906$ miles $(\zeta + \xi) \cdot r2d = 0.736$

General model parameters

$m := 1000$ number of base station in view of aircraft

$t := 100$ number of trials of 'm' base stations

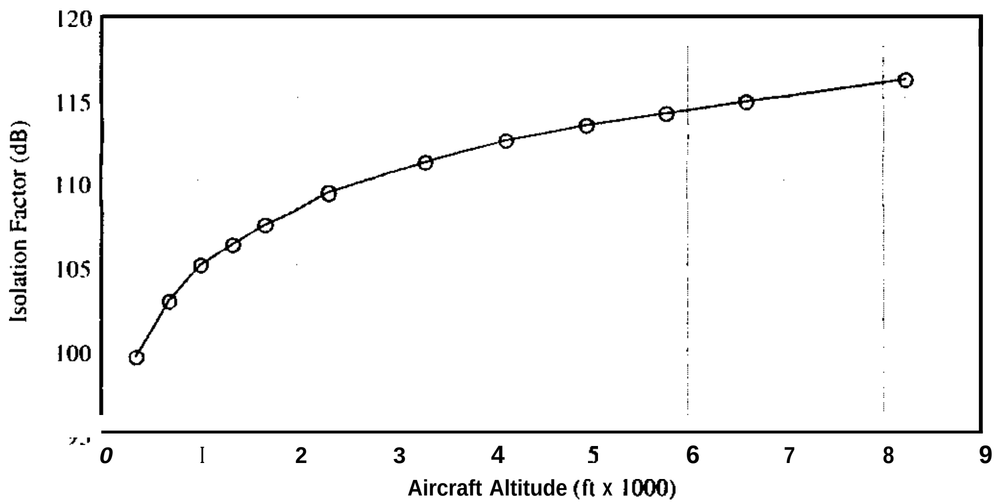
This plot looks at the change in isolation between the aircraft and the base station as a function of the aircraft altitude.

$$hei := \begin{pmatrix} 100 & -99.47 & 0 \\ 200 & -102.87 & 0 \\ 304.7 & -104.99 & 0 \\ 400 & -106.235 & 0 \\ 500 & -107.479 & 0 \\ 700 & -109.191 & 0 \\ 1000 & -111.024 & 0 \\ 1250 & -112.328 & 0 \\ 1500 & -113.282 & 0 \\ 1750 & -114.077 & 0 \\ 2000 & -114.795 & 0 \\ 2500 & -116.062 & 0 \end{pmatrix}$$

$k := 0..11$

$$hei_{k,2} := \left(hei_{k,1} - hei_{1,1}\right)$$

$$hei_{k,0} := \frac{hei_{k,0}}{1000} \cdot \frac{5280}{1.609 \cdot 1000}$$ convert altitude to (ft x 1000)



hei =

	0	1	2
0	0.328	-99.47	3.4
	0.656	-102.87	0
2	1	-104.99	-2.12
3	1.313	-106.235	-3.365
4	1.641	-107.479	-4.609
5	2.297	-109.191	-6.321
6	3.282	-111.024	-8.154
7	4.102	-112.328	-9.458
8	4.922	-113.282	-10.412
9	5.743	-114.077	-11.207
10	6.563	-114.795	-11.925
11	8.204	-116.0621	-13.192

$$ave := dB\left(\frac{1}{t+1}\cdot\sum_{i=0}^{t} real\left(atten_i\right)\right)$$

$ave = -105.461$

$min(atten) = -105.836$

$max(atten) = -104.956$

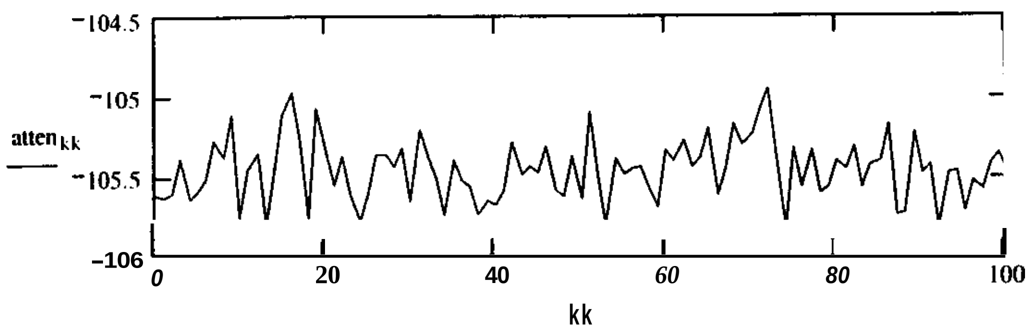
'ave' is the average expected coupling loss between all of the base stations and the aircraft receiver. The aircraft gain, path loss and transmitter discrimination summed across all of the base stations are accounted for. The min and max are the highest and lowest values across all of the trials. Adding the transmit EIRP and other non-geometrically based gains and losses will yield the power received by the aircraft receiver.

$m = 1 \times 10^3$ $hac = 304.735$

$t = 100$ $hbs = 30$

$mdist\cdot\frac{1}{1000} = 81.908$ km

$kk := 0..t$



atten =

	0
0	105.617
1	-105.63
2	105.604
3	105.399
4	105.645
5	105.589
6	105.522
7	105.282
8	105.377
9	105.122
10	-105.76
11	105.456
12	105.358
13	105.806
14	105.468

APPENDIX C3 – TECHNICAL EVALUATION OF BIG LEO ATC PROPOSALS

1.0 Introduction

This Appendix reviews the potential interference of various scenarios with the respect to Big LEO ATC operations in 1610-1626.5 MHz and 2483.5-2500 MHz Big LEO uplink and downlink bands, respectively. The Appendix describes, in Section 2, the assumptions used in the various analyses contained in this Appendix. Section 3 discusses the intra-system sharing between the two operating Big LEO systems. Finally, Section 4 discusses inter-system sharing between a Big LEO ATC system and other communication systems that could potentially be affected by interference resulting from the ATC operations.

The specific sharing analyses contained in this Appendix are:

Big LEO Uplink Band (1610-1626.5 MHz)

- Limitations on ATC Mobile Terminal (MT) out-of-band emission levels to protect out-of-band, inter-service systems; and
- Limitations on ATC MT out-of-band emission levels to protect out-of-band, intra-service systems.

Big LEO Downlink Band (2483.5-2500 MHz)

- Potential out-of-band interference from Big LEO ATC base stations operating in the downlink band (2483.5-2500 MHz) to ENG channels A8 (2450 – 2467 MHz) and A9 (2467-2483 MHz);
- Potential out-of-band interference from Big LEO ATC base stations operating in the downlink band to fixed and mobile (Part 90 and 101) licensed systems;
- Potential out-of-band Interference from Big LEO ATC base stations operating in the downlink band to ITFS/MMDS (Instructional Television Fixed Serviced Multi-channel Multi-point Distribution Service) above 2500 MHz;
- Potential out-of-band Interference from Big LEO ATC base stations operating in the downlink band to unlicensed 802.11b devices, and
- Potential in-band interference to (grandfathered) BAS, fixed and mobile systems in the 2483.5 – 2500 MHz band.

Figure 1.O.A shows the radio services allocated in the spectrum near the Big LEO uplink and downlink bands from both the ITU and the FCC Allocation Tables.

2.0 Assessment of Assumptions used in Technical Analysis

2.1 Out-of-Band Emissions of ATC Operations

Globalstar's ATC system proposal is based on either the IS-95 or the CDMA-2000 standard.[151] Table 2.0.A presents the pertinent characteristics of the IS-95 and CDMA-2000 terrestrial PCS systems.

Table 2.1.A Characteristics of Candidate Big LEO ATC systems

Item	Units	IS-95 Characteristics	CDMA-2000 Characteristics
Mobile Terminal			
EIRP	(dBW)	0.2-1.0	0.1
Bandwidth	(MHz)	1.23	1.25
Out-of-Band Emission Level		>900kHz -42 dBc/30 kHz >1.98 MHz -54 dBc/30 kHz	
Receiver Sensitivity	(dBW)	-134	-134.0
Interference Threshold	(dBW)	-138.9	-140.0
Base Station			
EIRP	(dBW)	32.0	27.0
Antenna Gain	(dBi)	19.0	17.0
Out-of-Band Emission Level		>750 kHz -45 dBc/30 kHz >1.98 MHz -60 dBc/30 kHz	
Receiver Sensitivity	(dBW)	-147.0	-149.0
Interference Threshold	(dBW)	-136.3	-144.0

3.0 Intra-Service Sharing Interference Analysis

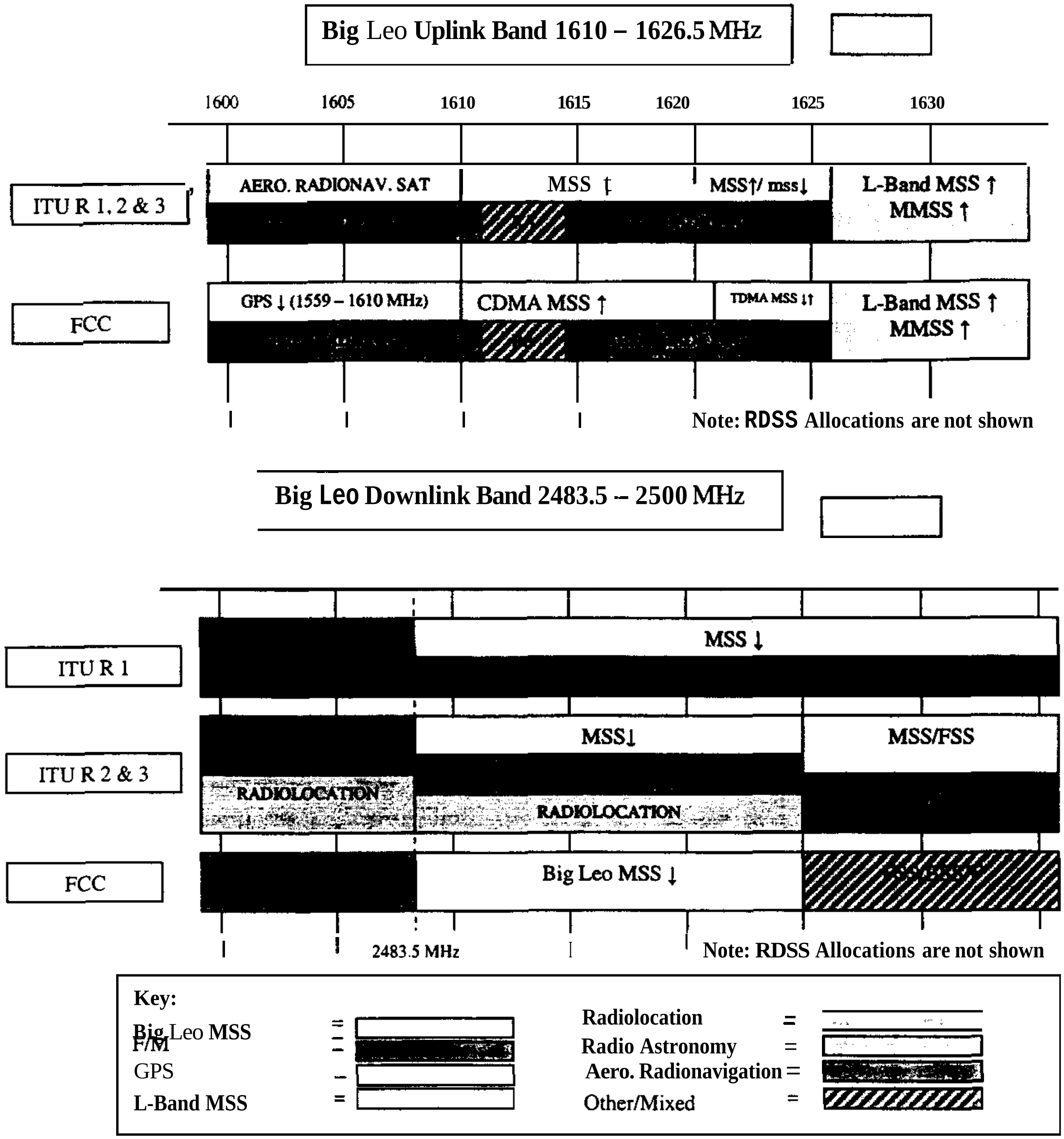
3.1 Intra-Service Sharing 1610-1626.5 MHz

Figure 1.O.A shows the allocations in the Big LEO uplink band. The MSS allocation from 1610 MHz to 1621.35 MHz is occupied by Big LEO systems utilizing direct sequence spread spectrum techniques. Globalstar is the only Big LEO system operating in this portion of the MSS uplink band. Therefore, the intra-service considerations are internal to the Globalstar system. Globalstar stated that it would assign separate frequencies to MSS and ATC operations varying the assignments on a timed basis.[152] The ATC services, which would be limited to relatively few cities, could cause co-frequency MSS services to be unavailable in areas of the United States where the satellite beam coverage included a co-frequency ATC city. These restricted frequency MSS areas would vary as satellites move in orbit and the coverage area changes. Globalstar also indicates that dynamically assigning some frequencies to ATC in selected cities while assigning different frequencies to the MSS operations will reduce the loss of the MSS coverage area. They

[151] Globalstar May 29,2002 Ex Pone Letter, Attach. A at 2-3

[152] See Globalstar June 27,2002 Ex Pone Letter at 2.

Figure 1.0.A Current Big LEO Table Allocations



	interpolated in dB/MHz to -10 at 1610 MHz[157]	
1628.5-1631.5	-45	1 MHz
1631.5-1636.5	-50	1 MHz
1636.5-1646.5	-55	1 MHz
1646.5-1666.5	-60	1 MHz

The proposed Big LEO ATC MTs are capable of meeting the recommended out-of-band emission levels of the Big LEO MSS systems contained in Table **4.1.1.A.**[158] The Commission requires Big LEO MSS systems to meet these same levels in order to protect inter-service operations in adjacent frequency bands.[159] The same out-of-band emission levels should apply to Big LEO ATC MTs to ensure the **same** level of protection to these inter-service systems.

Radioastronomy ***Service*** *(RAS).* Additionally, the Commission in its **1996** Big **LEO MO&O ruled** that harmful interference shall not be caused to stations of the radio astronomy service using the band **1610.6-1613.8 MHz** by stations of radiodetermination satellite[160] and mobile-satellite **services.**[161] The Commission's rules require that mobile earth stations have position-determination **capabilities**[162] to ensure compliance with out-of-band emission limits for MSS MES in areas around known RAS sites. The limits require that MES licensed in **the 1610-1626.5** MHz band produce power flux densities that do not exceed, at the **RAS,** the power **flux** density that would be produced by a MES operating in the **1610.6-1613.8MHz** bands at the edge of the site's protection **zone.**[163] In order to continue protection to RAS observations in this frequency band, the MSS ATC network should be capable of providing the **same** level of protection. Specifically, the MSS ATC systems could be required to meet the same out-of-band emission and position determination requirements as Big **LEO** MSS systems to respect the fixed-radius

(Continued from previous page)

157 According to the ITU, appropriate protection of GNSS needs to be considered, recognizing the current operation and phased transition of the GLONASS system into the new frequency plan. The Russian Federation states that the level of **-70** dBW/MHz shall be used to provide protection of GLONASS receiver operations and that a level of **-37 dBW/MHz** at **1 610** MHz, linearly interpolated to **–70** dBW/MHz at **1 607.5 MHz,** is sufficient to protect GLONASS wideband operations in the final GLONASS frequency plan.

158 In the technical statement filed by Globalstar on **5/29/02,** Globalstar stated its ATC system has typical out of channel **EIRP** of **-42 dBW/30khz** with **1.98** MHz offset, which is **-26** dBW/1MHz.

159 ***See GMPCS Report and Order,*** **17** FCC Rcd at **8927-28, ¶¶ 60-63**

160 There is no radio determination satellite system currently operating in the **1.6** GHz band.

161 ***Big*** LEO ***Memorandum Opinion and Order,*** 11 FCC Rcd at **12866, ¶ 15**

162 Position-determination equipment allows a mobile terminal to calculate, based on signals received from multiple satellite or ground-based stations, its geographic location and altitude. This information can then be used to determine if the mobile terminal is within the protected radio astronomy zone, and, if it is. to avoid transmitting signals that would cause harmful interference. In addition to GPS. the satellite-based global position system, and LORAN, a terrestrially based position determination system, Big LEO satellites may also, depending on system design, act as a source of position determination information for mobile terminals.

163 For MSS operations outside of the United States. the stations will observe limits set by the ITU RR Article **5.364.**

also indicate that MSS operators could reserve some spectrum for MSS-only operations. Thus the inter-service sharing is managed within the Globalstar system.

The 1621.35 MHz to 1626.5 MHz band is occupied by Big LEO systems using TDMA transmission techniques. Iridium is the only Big LEO system occupying this band. At the time the *Big LEO Service Rules Order* was released. the Commission declined to address comprehensively the issue of emission limits between MSS systems due to the early development of a regulatory structure conductive to the rapid and successful deployment of the Big LEO's services.[153] The Commission did, however, adopt a band arrangement to accommodate these and additional Big LEO MSS systems, as well as maximum MT EIRP levels and out-of-band emission levels.'" The same band plan, power and out-of-band emission levels for MSS ATC will provide for continued MSS use of the 1610-1626.5 MHz band with ATC operations.

3.2 Intra-Service Sharing 2483.5-2500 MHz

The MSS downlink allocation from 2485.3 MHz – 2500 MHz is occupied solely by Globalstar. Therefore, the intra-service considerations are internal to the Globalstar system.

4.0 Inter-Service Sharine Interference Analysis

4.1 Inter-Service Sharing 1610-1626.5 MHz

4.1.1 Limitations on ATC MT Out-Of-Band Emission Levels to Protect Adjacent Band Systems

Global Positioning System (GPS). Out-of-band emission levels for ATC MT transmitters are required to protect Radionavigation Satellite Service (RNSS) systems such as GPS and L-band Mobile Satellite Service (MSS) systems such as Inmarsat from potentially unacceptable interference. This specific interference issue has been resolved for Big LEO MSS systems that have MSS Mobile Earth Station (MES) that operate in accordance with Recommendation in ITU-R M.1343.[155] ITU-R M.1343 recommends the maximum unwanted emissions outside the band 1610-1626.5 MHz for an MSS MES. An excerpt from ITU-R M.1343 is provided below in Table 4.1.1.A.

Table 4.1.1.A Out-of-Band Emissions into GPS Band

Frequency (MHz)	Carrier-on	
	EIRP (dBW)	Measurement Bandwidth
1590-1605	-70[156]	1 MHz
1605-1610	-70 at 1605 MHz, linearly	1 MHz

[153] *Big* LEO Service Rules *Order.* 9 FCC Rcd at 5962,163

[154] See 47 C.F.R. §§ 2.106, 25.202(f).

[155] International Telecommunications Union, *Essential Technical Requirements* of Mobile *Earth Stations for* Global *Non-Geostationary* Mobile *Satellite* Service *Systems in* the Band *1-3 GHz*, Recommendation ITU-R M.1343 (1997).

[156] This value is subject to further study in ITU-R according to Recommendation ITU-R M.1343.

the ATC MTs. With the rules mentioned in the previous paragraph requiring the MSS operators to be notified of any move of a temporary-fixed station, we find that all of the information is available to the MSS operators to coordinate their base stations. We therefore require the MSS ATC operator to coordinate the placement of its base stations with the grandfathered fixed and temporary-fixed stations in this band.

4.2.2 Potential Out-Of-Band Interference from Big LEO ATC Base Stations Below the MSS Downlink Band (2483.5-2500 MHz)

Electronic News Gathering (ENG) Channels A8 (2450 – 2467 MHz) and A9 (2467-2483 MHz). The Society of the Broadcast Engineers (SBE) commented that MSS ATC base stations will cause out-of-band interference and brute force overload to ENG equipment operating in TV BAS ENG Channels A8 and A9 in the 2483.5-2500 MHz band.[169] Currently, 405 TV BAS licenses are issued nationally in the range 2450 MHz to 2483 MHz. There are 87 licensed facilities used for TV inter-city relay, 297 TV pickup licenses, 19 TV studio transmitter links, and 2 TV translator relay licenses. SBE also claims that ENG channel A10 (2483-2500) is operating at the same frequency as the Big LEO space-toearth (downlink) component. However, our records indicate that there are no grandfathered BAS facilities licensed in the 2483.5 – 2500 MHz Band. However, because ENG did, at one time, operate on Channel A10, it is possible that equipment exists that has front end filters that do not isolate the ENG receiver from transmissions in the 2483.5-2500 MHz band. This would constitute a co-frequency situation as discussed in Section 4.2.1. This Section is limited to potential interference to ENG from ATC base stations out-of-band interference.

The proposed Big LEO ATC base station has a typical in-band transmitter power of 20 W.[170] Furthermore, the proposed out of channel emission for the ATC base station is approximately 4 5 dBc with frequency offset between 750 KHz and 1.98 MHz from the center; and -60 dBc with frequency offset 1.98 MHz or more. In areas of frequency congestion, the BAS receive stations operating in the 1990-2110 MHz band are required to use Category A antennas, which have 3 dB beam widths of 5 degrees and minimum front-to-back ratios of 38 dB.[171] An antenna with a beam width of 5 degrees would have a gain of approximately 30 dBi. It is assumed that stations operating just below 2485.3 MHz would use similar equipment. The BAS receiver is also assumed to have a sensitivity of -86 dBm and that a 10 dB D/U ratio is acceptable in this adjacent band situation.[172]

Table 4.2.1.A calculates the required separation distance to provide protection to a BAS receiver under two conditions:

- main-beam to main-beam coupling between the ATC base station transmitter and the BAS receiver with a frequency separation of 0.75 MHz, and
- main-beam coupling between the ATC base station transmitter and the back-lobe of a BAS receiver with a frequency separation of 2.0 MHz.

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[169] SBE Comments at 10.

[170] Globalstar May 29, 2002 Ex *Parte* Letter at 3.

[171] See 47 C.F.R. § 74.641.

[172] The D/U ratio is taken from on SBE's Ex *Parte* comments filed in ET cket 142, August 7, MI.

protection zones for radio astronomy sites listed in section **25.213** of the Commission's rules and not operate within those zones during periods of radioastronomy observations. This would significantly mitigate any potential interference caused to the RAS from MSS ATC MT operations.

4.2 Inter-Service Sharing 2483.5-2500 MHz

4.2.1 Potential Interference from Big LEO Base Stations *to* Fixed and Mobile Stations Operating in *the* 2483.5-2500 MHz Band

Over **700** fixed terrestrial stations, including temporary fixed (transportable) stations, were licensed and operating in the United States in the 2483.5-2500 MHz band as of **1994.'"** These stations are primarily used as links in microwave relay systems serving petroleum companies and as broadcast auxiliary links. Since **1985,** however, the Commission has prohibited any further terrestrial licensing in this band but has permitted the existing stations licensed as of July 25, **1985** to be "grandfathered" in the 2483.5-2500 MHz band subject only to license renewal.'" In the Big *LEO Report and* Order, the Commission recognized that mutual interference was possible between the fixed and mobile systems and the MSS mobile earth terminal receivers, on the one hand, and the satellite downlinks operating in excess of the prescribed pfd levels and the fixed and mobile receivers on the other **hand.**[166] In the *RDSS Allocation* Order, we recognized that fixed and temporary-fixed operations are unlikely to pose a serious interference threat to RDSS.[167] However, we acknowledged that coordination would be somewhat more. difficult when temporary-fixed stations are involved since RDSS licensees would not have exact information regarding the location of these stations. Therefore, we required temporary-fixed licensees in this band to notify RDSS licensees directly whenever the station is moved to a new location. We also recognized that a similar interference environment is present with MSS operations. Consequently, we modified the Commission's rules to extend the notification requirement for grandfathered temporary-fixed licensees to MSS licensees as well as RDSS licensees.'"

The operation of ATC base stations in the 2483.5-2500 MHz band could potentially cause interference to the grandfathered fixed and temporary-fixed stations in this band. Additionally, there is a potential for interference from the grandfathered fixed and temporary-fixed stations to

[164] *Big LEO Service Rules Order,* 9 FCC Rcd at 5992, ¶ 145.

[165] *Allocaring Spectrum for and Establishing Other Rules and Policies Perraining to a Radiodetermination Satellire Service.* 50 Fed. Reg. 39101, 39104, ¶ 20 (1985) *(RDSS Allocation Order); see also* 47 C.F.R. §§ 90.20(c)(3)(73), 90.35 (c)(74), 90.103(b)(9) and 101.147(f)(2).

[166] *Big LEO Service Rules Order,* 9 FCC Rcd at 5992, ¶ 146

[167] *RDSS Allocation Order, 50* Fed. Reg. at 39104, ¶¶ 18-20

[168] Under 47 C.F.R. § 101.4(a), all systems subject to parts 21 and 94 as of July 31, 1996 that are licensed or which are proposed in an application on file as of July 31, 1996 are subject to the requirements under part 94 as contained in the Code of Federal Regulations edition revised as of October I, 1995 and amended in the Federal Register through July 31, 1669, as applicable, indefinitely. *See* 47 C.F.R § 94.61(b)(4) (1995). Note that 47 C.F.R. § 94.61(b)(4) (Oct. 1, 1995) states that grandfathered temporary fixed licensees are required to notify directly each RDSS and MSS licensees concerning present and proposed locations of operations.

Safety Pool, Industrial/Business Pool, and Radiolocation Service) and Part 101 (Fixed Microwave Service) in addition to Part **74** (Television Broadcast Auxiliary Service). Licenses in this band are used significantly by television stations that operate ground-based and airborne video equipment and also by public safety agencies that are increasingly using the band for live airborne video and for other public safety functions requiring video links. The analysis of the separation distances for BAS protection versus Big LEO ATC base stations presented earlier in this section would pertain directly to the BAS uses licensed under Part **74** to the extent that these Part **90** and Pan 101 uses are similar to Pan **74.** Part **74** and 101 users coordinate their use of the band. Some of these uses are known to be lower power video links. The impact of the ATC base stations on such links could be examined if license information were available in a prior coordination process. Part 90 users are not required to coordinate, although the FCC encourages their participation in a collaborative coordination effort. ATC operators will be required to take measures to protect against all types of interference to the existing users in this shared band.

Unlicensed 802.11b Devices. Although Industrial, Scientific and Medical (ISM) equipment is not subject to any protection from current MSS downlink operations, our research indicates that most **802.11b** manufacturers build out-of-band signal rejection features into their hardware. Specifically, in the United States, **802.11b** devices operate on channel frequencies ranging from **2412** MHz to **2462 MHz**. Lucent Technologies, for example, has also shown in a laboratory test conducted in **1998** that its WaveLAN wireless card can reject up to **35dB** when **an** interfering channel is **25** MHz **away.**[173] Due to the location the upper band edges of unlicensed **802.11b** devices (i.e., **2462** MHz), unlicensed **802.11b** devices operating in the United States should have enough signal rejection capability to reject Big LEO ATC base station transmissions.

4.23 Potential Out-Of-Band Interference from Big **LEO** ATC Base Stations Operating Above the MSS **Downlink** Band (2483.5-2500 MHz)

Instructional Television Fixed Services/Multi-Channel Multi-point Distribution Service (ITFS/MMDS). SBE indicated that there is a potential for ATC transmissions to interfere with ITFS/MMDS receivers operating above **2500 MHz.**[174] In order to calculate the required separation distance between Big LEO ATC transmitters and an ITFS/MMDS receiver operating in the adjacent frequency band, the maximum undesired ATC power flux density that would cause interference to a ITFS/MMDS receiver is first determined. Next, the distance between the ATC transmitter and the ITFS/MMDS receiver is calculated at the point where the received power flux density at the ITFS/MMDS receiver is equal to or less than the level that would cause it unacceptable interference. According to the proposed base station data provided by Globalstar, ATC base stations would have a maximum out-of-band **EIRF'** of -40 **dBW.**[175] The maximum undesired signal power flux density for an ITFS/MMDS station is **-129** dBW/m^2 for a **1.25** MHz interfering **signal.**[176] The minimum required separation distance between an ITFS/MMDS receiver and a Big LEO ATC base station can be calculated by using the following formula:

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173 WaveLAN Technical Bulletin 003/A, Lucent Technologies,(Nov. 1998).

174 SBE Comments at 10.

175 ***See Interim Report on the Spectrum Study of the 2500-2690 MHz Band. supra,*** at **A60** n.2. Typical out-of-band EIRF' for an **IS-95** system, the alternative CDMA2000 mentioned by Globalstar is expected to have a lower out-of-band emission. Therefore, -40 dBW can be used as the worst case scenario.

176 The bandwidth here is typical for an IS-95/CDMA2000 system.

Table 4.2.1.A calculates the out-of-band emission from the base station and the interference threshold for the BAS station. The difference between the two values is the required isolation that must exist between the transmitter and receiver to prevent interference from occurring. Table 4.2.1.A uses free space propagation. In urban environments, more sophisticated propagation models would probably identify greater path loss and the corresponding reduction in the required separation distance between the base station and BAS receiver. However, since the free-space model is the worst-case model, we take the more conservative approach in our analysis.

The results of Table 4.2.1.A show that under main-beam to main-beam coupling conditions a required separation distance of more then 4 km can result. The Table also indicates that it may be possible to have a very small separation distance by situating the base station in the back lobe of a fixed BAS antenna and/or incorporating some frequency separation between the BAS channel A09 and the base station transmit frequency.

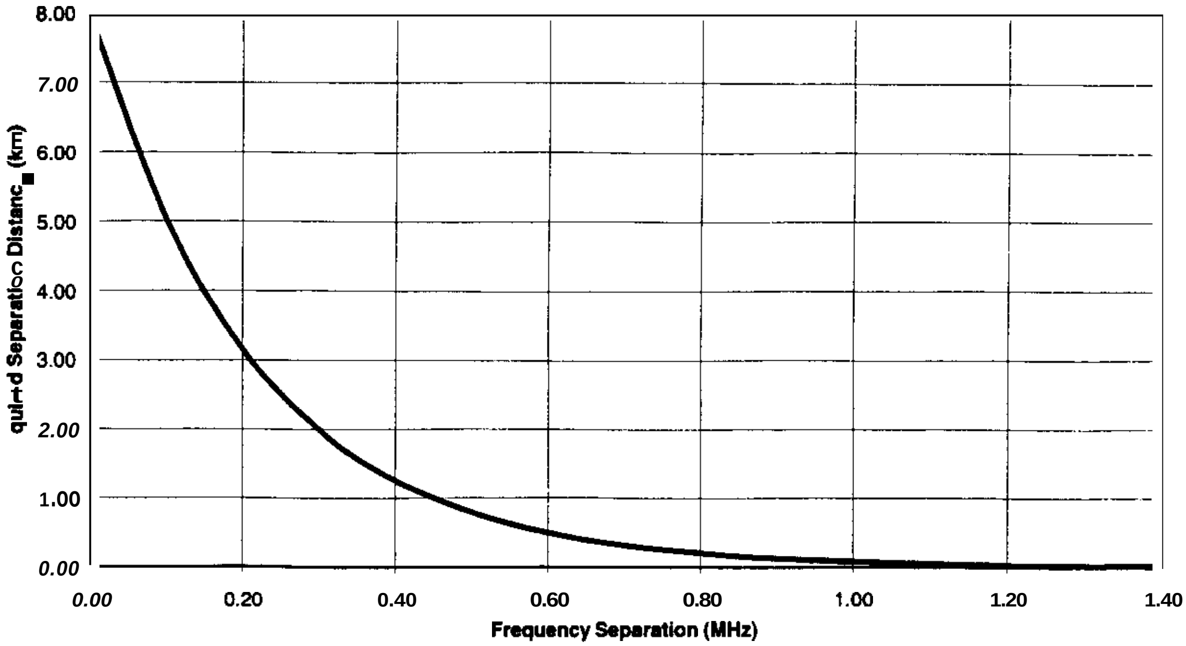
Table 4.2.1.A BAS versus Big LEO ATC Interference Calculation

Item	Units	Main-Beam Value	Back-Lobe Value
IS-95 System			
Frequency	(GHz)	2.483	2.483
ATC Emission Bandwidth	(MHz)	1.23	1.23
BAS Channel Bandwidth	(MHz)	16.5	16.5
ATC Transmit Power	(W)	20.0	20.0
ATC Transmit Gain	(dBi)	19.0	19.0
ATC EIRP	(dBW)	32.0	32.0
Frequency Separation	(MHz)	0.75	2.0
OOB Reduction	(dBc)	-45.0	-60.0
OOB Emission	(dBW)	-13.0	-28.0
BAS Receiver			
Assumed Sensitivity	(dBm)	-86.0	-86
Required D/U	(dB)	10.0	10.0
Receive Antenna Gain	(dBi)	30.0	-8.0
Area of Isotropic Antenna	(dBm^2)	-29.3	-29.3
Interference Threshold @ Antenna	(dBW/m^2)	-96.1	-58.7
OOB Emission (From Above)	(dBW)	-13.0	-28.0
Required Isolation	(dBm^2)	83.7	30.7
Required Distance (Free Space Loss)	(km)	4.3	0.01

From a spectrum efficiency standpoint, Big LEO ATC operators should implement the least amount of frequency offset necessary to avoid causing unacceptable interference to BAS receivers. It appears from our analysis that coordination of the ATC base stations to protect BAS operations in Channel A09 is possible.

Wireless Services in 2450-2483.5 MHz Band. The FCC actively licenses several services in the 2450-2483.5 MHz band allocated for shared fixed, base, or mobile use under Part 90 (Public

Figure 4.23A ITFS/MMDS Required Separation Distance versus Frequency Separation



It appears from our analysis that ATC operations on frequency assignments below 2498 MHz would not cause unacceptable interference to ITFS/MDS receivers in the adjacent frequency band. As with the TV BAS evaluation, this analysis assumes that the ITFS/MDS receiver is in direct line of sight of the Big LEO base station transmitter and there is no additional attenuation of the interfering transmission. Use of a propagation model that takes into account the effects of an urban environment in this frequency range would likely produce a smaller separation distance.

Minimum required separation distance $= \sqrt{\frac{EIRP}{PowerFlux * 4 * \pi}}$, where the Power Flux has a reference bandwidth of 1.25 MHz.

The maximum separation distance between an ATC base station and an ITFS/MMDS receiver necessary to avoid adjacent channel interference is 8 km (5 miles) assuming that the ITFS/MMDS receiver is operating directly adjacent to 2500 MHz. The ITFS/MMDS receivers can reject up to 40 dB/MHz according to measurements conducted by the FCC laboratory.[177] Table 4.2.2.A and Figure 4.2.2.A evaluate the required separation distance as a function of the proposed ATC frequency assignments.

Table 4.23.A ITFS/MMDS Typical Calculation of Required Separation Distance for a Specific Frequency Separation

Item	Units	Value
Frequency	(GHz)	2.5
Bandwidth	(MHz)	1.23
EIRP	(dBW)	-40.0
Frequency Offset	(MHz)	0.5
ITFS Roll-Off	(dB/MHz)	40.0
Calculated Roll-Off	(dB)	20.0
Effective EIRP (Including Roll-Off)	(dBW)	-60.0
Interference Threshold	(dBW/m^2 in 1.25 MHz)	-129.0
Separation Distance	(km)	0.80
Separation Distance	(miles)	0.49

177 *Spectrum Study of the 2500-2690 MHz Band: The Potential for Accommodating Third Generation Mobile Systems*, Final Report, App. 5.2 (rel., March 30, 2001), *available at* <http://www.fcc.gov/3G/3gfinalreport.doc> (last visited, Feb. 4, 2003) (*Final Report on the Spectrum Study of the 2500-2690 MHz Band*).

APPENDIX D FINAL REGULATORY FLEXIBILITY CERTIFICATION

Report and Order

1. The Regulatory Flexibility Act of 1980, as amended (RFA),[1] requires that a regulatory flexibility analysis be prepared for notice-and-comment rule making proceedings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."' The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."' In addition, the term "small business" has the same meaning as the term "small business concern'' under the Small Business Act.[4] A "small business concern" is one which (1) is independently owned and operated (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the U.S. Small Business Administration (SBA).[5] The SBA has developed a small business size standard for Satellite Telecommunications, which consists of all such companies having $12.5 million or less in annual revenue!

2. Pursuant to the RFA, the Commission incorporated an Initial Regulatory Flexibility Analysis (IRFA) into the *Flexibility* Notice? We received no comments in response to the IRFA. For the reasons described below, we now certify that the policies and rules adopted in the present *Flexibility* Order will not have a significant economic impact on a substantial number of small entities.

3. The *Flexibility* Order provides additional operational flexibility for MSS providers that operate in three sets of radio frequency bands: the 2 GHz MSS band, the L-band, and the Big LEO bands. The flexibility consists of permitting the MSS providers to integrate ancillary terrestrial components (ATC) into their networks.* We find that providing this flexibility will have no significant economic impact on small entities because the MSS operators will not be required to *make* use of the additional capability. We believe that permitting the additional flexibility will enhance the ability of MSS operators to offer American consumers high quality, affordable mobile services on land, in the air, and over the oceans without using spectrum resources beyond the spectrum already allocated and authorized for MSS use in these bands. Operational flexibility will: (1) increase efficient spectrum use through MSS network

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[1] The RFA, see 5 U.S.C. §§ 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[2] 5 U.S.C. § 605(b).

[3] 5 U.S.C. § 601(6).

[4] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small-businessconcern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency. after consultation with the Officeof Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

[5] 15 U.S.C. § 632

[6] 13 C.F.R. § 121.201, NAICS code 517410

[7] *Flexibility Notice,* 16 FCC Rcd at 15565-67, ¶¶ 85-93.

[8] See *generally* § II.A., *supra*

APPENDIX E INITIAL REGULATORY FLEXIBILITY ANALYSIS

1. As required by the Regulatory Flexibility Act (RFA),[1] the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities by the policies and rules proposed in this Notice. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments in the ***Report and Order and*** Notice of ***Proposed*** Rulemaking provided above in section V. The Commission will send a copy of the Notice, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration.[2] In addition, the Notice and JRFA (or summaries thereof) will be published in the Federal Register.[3]

1. Need for and Objectives of the Proposed Rules

2. This Notice seeks comment on proposals for reassigning or reallocating a portion of spectrum in the Big LEO MSS frequency bands. Given the state of the Big LEO MSS industry including changing traffic patterns, consumer demand and a recent request for additional spectrum by Iridium, one of the Big LEO operators, the Notice seeks comment on: (1) the Commission's original spectrum sharing plan, (2) the proposal of Iridium for additional spectrum and (3) other possible uses of the band.

2. Legal Basis

3. This action is taken pursuant to Sections 1, and 4(i) and (j) of the Communications Act, as amended, 47 U.S.C. § § 151, 154(i), 154(j), and Section 201(c)(11) of the Communications Satellite Act of 1962, as amended, 47 U.S.C. § 721(c)(11), and Section 553 of the Administrative Procedure Act, 5 U.S.C. § 553.

3. Description and Estimate of the Number of Small Entities to which the Proposed Rules Would Apply

4. The RFA directs agencies to provide a description of, and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted![4] The RFA defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction" under Section 3 of the Small Business Act.[5] A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[6]

5. The Commission has not developed a definition of small entities applicable to geostationary or non-geostationary orbit fixed-satellite or mobile satellite service operators. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) tules applicable to Communications Services, Not Elsewhere Classified.[7] This definition provides that a

[1] **See** 5 U.S.C. § 603. The RFA, **see** 5 U.S.C. § 601 ***er. seq.***, has been amended by the Contract With America Advancement Act of 1996. Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

[2] **See** 5 U.S.C. § 603(a).

[3] **See *id.***

[4] 5 U.S.C. § 603(b)(3).

[5] *Id.* § 601(3).

[6] *Id.* § 632.

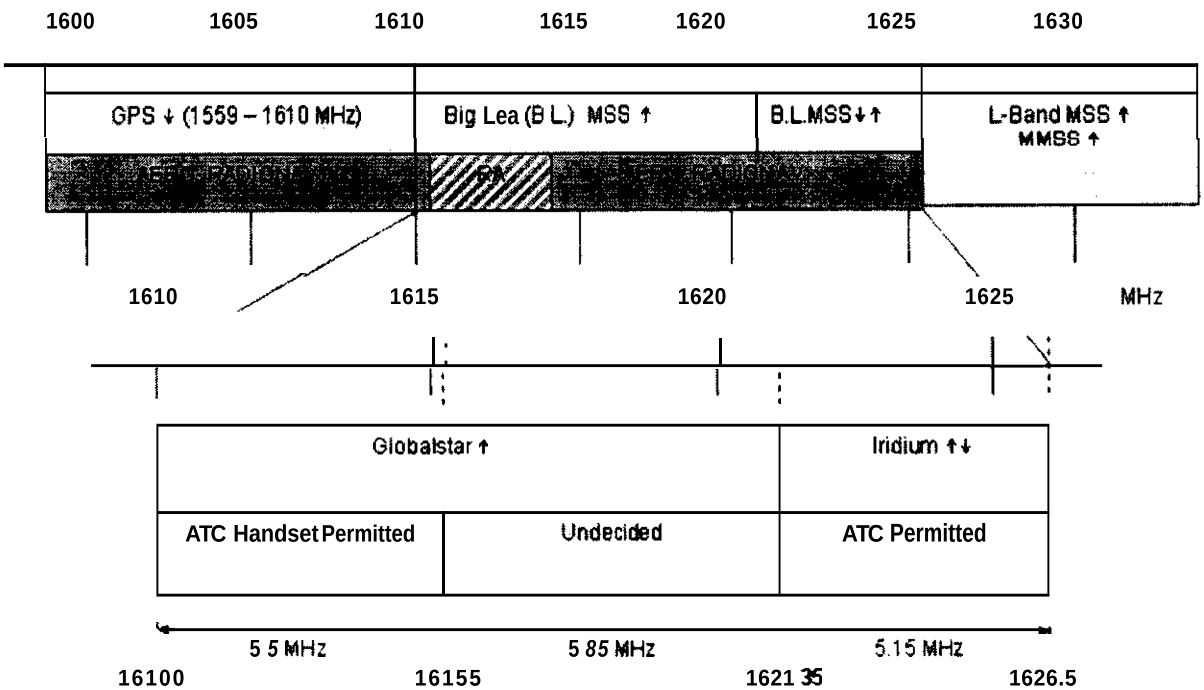
[7] 13 C.F.R. § 121.201, NAICS Code 51334.

integration and terrestrial reuse; (2) reduce costs, eliminate inefficiencies, and enhance operational ability in MSS systems; (3) encourage technological innovation and the development of new wireless applications; and (4) strengthen competition in the telecommunications marketplace both in the United States and in other nations. We implement the *Flexibility* Order through the addition of a footnote to the U.S. Table of Frequency Allocations, found in Section 2.106 of our Rules, 47 C.F.R. § 2.106.

4. We also find that our action – which brings additional flexibility to existing MSS licensees -- will not affect a substantial number of small entities. There are currently five 2 GHz MSS licensees, two Big LEO MSS licensees and three L-band MSS licensees authorized to provide service in the United States. Although at least one of the 2 GHz MSS system licensees and one of the Big LEO licensees are small businesses, small businesses often do not have the financial ability to become MSS system operators because of the high implementation costs associated with satellite systems and services. We expect that, by the time of MSS ATC system implementation, these current small businesses will no longer be considered small due to the capital requirements for launching and operating a proposed system.

Appendix F

Big LEO Uplink Band 1610 – 1626.5 MHz



small entity is one with $11.0 million or less in annual receipts. According to Census Bureau data, there are 848 firms that fall under the category of Communications Services, Not Elsewhere Classified which could potentially fall into the L-band, Big LEO or 2 GHz MSS category. Of those, approximately 775 reported annual receipts of $11 million or less and qualify as small entities. The options proposed in this *Notice* apply only to entities providing Big LEO MSS. Small businesses may not have the financial ability to become MSS system operators because of the high implementation costs associated with satellite systems and services. At least one of the Big LEO licensees may be considered a small business at this time. We expect, however, that by the time of implementation they will no longer be considered small businesses due to the capital requirements for launching and operating their proposed systems. Therefore, because of the high implementation costs and the limited spectrum resources, we do not believe that small entities will be impacted by this rulemaking to a great extent.

4. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

6. The proposed action in this *Notice* would affect those entities applying for Big LEO MSS space station authorizations and those applying to participate in assignment of Big LEO MSS spectrum, including through potential re-allocation. In this *Notice,* we tentatively conclude that a re-balancing of the Big LEO MSS band will serve the public interest. We seek comment on the current use of the Big LEO MSS uplink band (1610-1626.5 MHz) by the current licensees, Iridium and Globalstar, any potential impact on GLONASS, the Russian Global Navigation Satellite System and radioastronomy, and Big LEO MSS service downlink (2483.5-2500 MHz) spectrum uses. We also seek comment on the possibility of making Big LEO MSS spectrum available in a second Big LEO processing round, re-allocating a portion of the Big LEO spectrum for other uses, including unlicensed devices, site-based or critical infrastructure licensees, or assignment to a terrestrial commercial mobile radio service licensees. We do not propose any other reporting, recordkeeping or compliance requirements in the *Notice.*

5. Steps Taken to Minimize Significant Economic Impact on Small Entities and Significant Alternatives Considered

7. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives: (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities: (2) the clarification. consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.

8. In developing the tentative conclusion and the proposals contained in this *Notice,* we have attempted to allow flexibility for efficient operations in the Big LEO MSS market, regardless of size, consistent with our other objectives. We have also sought comment on other uses of the spectrum that may enhance service to the public. We believe that our tentative conclusion that the Big LEO MSS band should be re-balanced, our request for comment on the current use of the band by the Big LEO licensees, and our request for comment on other uses of the band will not impose a significant economic impact on small entities because: (1) the information sought is reasonable and not overly burdensome: and (2) as mentioned above, we do not expect small entities to be impacted by this *Notice* due to the substantial implementation costs involved to use the spectrum at issue in this *Notice.* Nonetheless, we seek comment on the impact of our proposals on small entities and on any possible alternatives that could minimize any such impact.

6. Federal Rules that May Duplicate, Overlap, or Conflict with Proposed Rules

9. None

SEPARATE STATEMENT OF
CHAIRMAN MICHAEL K. POWELL

Re: ***Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands***

Re: ***Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems.***

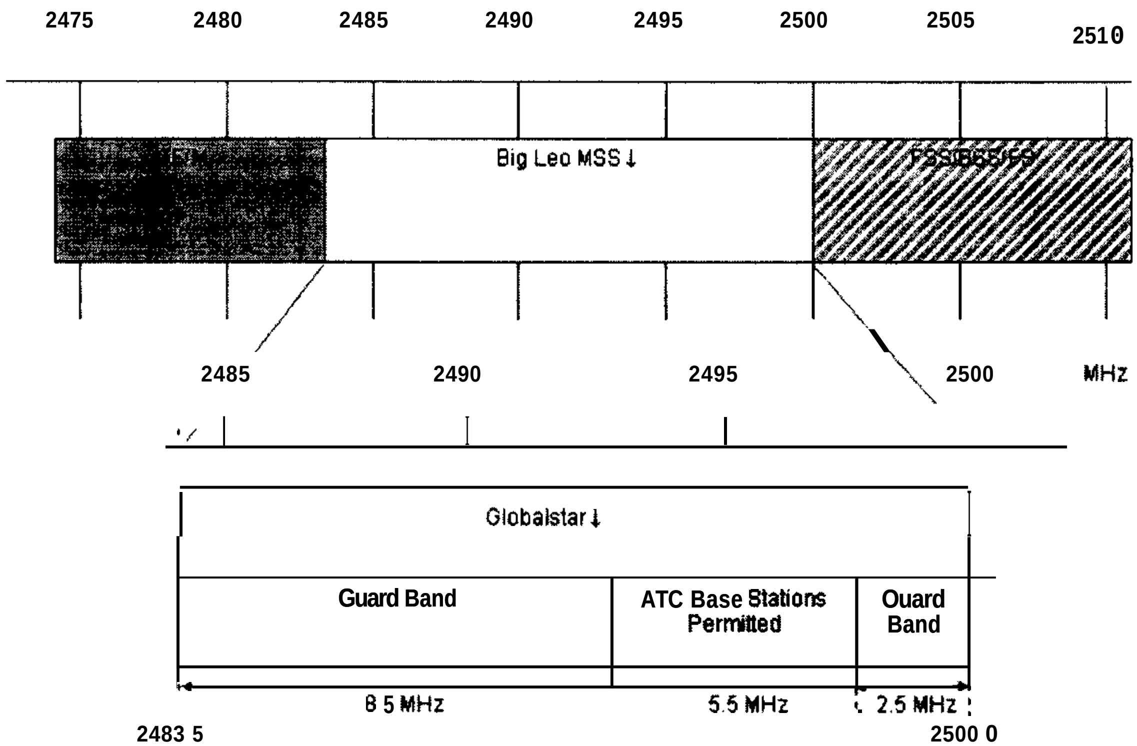
Today the Commission releases a family of orders that grants flexibility to licensees that provide substantial satellite service, strictly enforces our satellite milestone policies, and reallocates 30 MHz of spectrum for terrestrial use. Taken together, these orders reflect the Commission's commitment to vigorously guard the public's spectrum resource and to ensure that resource is used efficiently in the public interest. In addition, these orders will further increase the portfolio of spectrum-based services emerging as viable competitors in the voice and broadband marketplace. While I believe today's orders represent the optimal outcome under the constraints of the existing licensing regime, they also highlight areas of our current spectrum policy that warrant particular attention, from the Commission and Congress, if we are to maximize the public interest in spectrum policy.

First, we grant existing satellite providers in three bands the option of using their spectrum assignments on the ground as well as in space. Under our traditionally bifurcated licensing regime, satellite and terrestrial spectrum rights have been assigned independent of one another. In some cases, assignment of either satellite or terrestrial rights effectively barred the assignment of the other because of interference concerns. Advances in technology have changed some of these assessments. Sharing is now often possible between satellite and terrestrial, fixed services. Indeed, in cases where the services are severable, the Commission has decided to license the rights to different parties. In other cases, the capacity of two independent services to share is far more limited.

In the bands at issue here, the satellite-based services as well as the proposed terrestrial services are mobile, making sharing less feasible. Moreover, the satellite services are already licensed and, in two of the three bands at issue, satellite licensees are already offering service. In the end, I concluded that granting additional rights to existing satellite licensees best protected those services from harmful interference and ensured the spectrum currently allocated to satellite services in these three bands was fully utilized. The dissent argues that the Commission should have sought additional comment on our authority to assess a fee on satellite licensees who would be granted these additional rights. As an initial matter, it should be pointed out that the Commission already sought comment in this proceeding on that very issue. Further comment seems unproductive. However, I concur in the recommendation of the Spectrum Policy Task Force that Congress consider granting the Commission fee authority. Authorizing such fees would provide the Commission with an important tool for ensuring efficient use of the public spectrum resource.

Second, today's orders emphasize the importance of milestones in our satellite licensing regime. The Commission has long acknowledged that satellite-based communications present unique challenges. Specifically there is often a tremendous lag time between the filing of an application and the actual provision of service. The ITU satellite filing and coordination regime further complicate this process. The time and regulatory resources involved strongly counsel in favor of policies that ensure satellite spectrum goes to providers committed to using the spectrum promptly. Strict enforcement of milestones ensures this result. We will continue to be vigilant that satellite licensees fulfill their obligations to build

Big LEO Downlink Band 2483.5 – 2500 MHz



SEPARATE STATEMENT OF

COMMISSIONER KATHLEEN Q. ABERNATHY

Re: *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2GHz Band, the L-Band, and the 1.6/2/4 GHz Bands and Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands, IB Docket No. 01-185 and IB Docket No. 02-364.*

By granting flexibility to mobile satellite service providers we are maximizing the value of the radiocommunications spectrum resource to deliver benefits to consumers consistent with the Commission's statutory obligations. In this proceeding the Commission was faced with balancing several public interest goals in determining how to maximize the efficiency of the spectrum resource in the 2 GHz, the Big Leo and the L bands. I believe that granting mobile satellite service providers the ability to add an ancillary terrestrial service component to their service offerings balances these goals in a manner that best serves the public interest.

Specifically, the record in this proceeding demonstrates that the shared usage of these bands by separate MSS operators and terrestrial operators would likely result in the inability for both systems to operate effectively. This is especially the case for L-band and Big Leo satellite operations. Therefore, the Commission was faced with a difficult decision: it could either isolate out the terrestrial rights from the satellite rights and auction these licenses separately despite the technical limitations, or allow integrated ancillary terrestnal use of these bands by MSS operators. In permitting an ancillary terrestrial component, the Commission will enable enhanced operations by the MSS licensees. While some had argued the terrestrial component of the spectrum should be auctioned, such an option would have devalued the amount of spectrum usable by any entity and denied services to consumers.

The record reflects many public interest benefits associated with the provision of global mobile satellite services, including the ability of these systems to provide service to rural and remote locations where traditional services may not yet operate. In addition, satellite operators have the potential to develop ubiquitous mobile telecommunications and broadband services. The Commission has adopted stringent requirements that must be met by the satellite operator to ensure that an ATC applicant will provide its terrestrial component consistent with the ancillary use requirement. These include requirements that the ATC applicant provide substantially a satellite service and that the provision of any terrestrial service remains an integrated service component of the overall satellite system.

Spectrum is important because it is a finite natural resource with immense potential value to the American people. That value is derived from commercial services, public safety and national security. Of course, fallow spectrum in general has little value. So the Commission's goal is to create regulatory policies that foster effective investment to deliver services. I believe that today's action helps to move this goal forward in the near future.

systems – or the spectrum will be returned and re-licensed. Adherence to the obligation to construct new systems also advances our goal of multiple, facilities-based competitors in all sectors of the communications marketplace, including satellite services.

While milestone enforcement is an important policy, the Commission is also examining its satellite policies in a broader context to determine whether our processes unduly hinder market access, and thereby limits competition in voice, broadband, and other markets. The Commission is currently reassessing its satellite licensing regime to determine what improvements can be made. Our current system takes much too long and makes the challenges associated with launching and operating a satellite service all the more complex. Satellite providers should succeed or fail in the marketplace on their own merits – not to have their business plans atrophy on the shelf while the FCC takes years to issue a license. We can and must do better.

Finally, the Commission today reallocates **30** MHz of spectrum at 2 GHz previously allocated for satellite use. The Commission also seeks comment on reallocating additional spectrum in the Big LEO band. These actions are not taken lightly. However, **I** believe that the highest-valued use of this spectrum is no longer for satellite service, and it is more prudent to explore other uses.

Going forward, it would be best if the Commission were not called upon to make such command-and-control determinations. If, for example, Congress were to repeal the international satellite competitive bidding prohibition in the ORBIT Act as the Task Force recommended, the Commission would be able to adopt a flexible allocation including satellite and terrestrial uses. If mutually exclusive applications were then accepted for filing, the resulting auction would allow the marketplace – rather than the Commission – to decide the highest valued use of the spectrum in question. I believe such an outcome would maximize the public interest and, accordingly, ask Congress to consider allowing the FCC the option of distributing flexible spectrum rights via auction.

Once the Commission determined that 30 MHz of satellite spectrum at **2 GHz** would be reallocated, we faced the challenging task of selecting the appropriate bands. One of the most difficult aspects of that decision was to reallocate **10 MHz** of globally harmonized spectrum at **1990-2000 MHz**. Globally harmonized spectrum is a vital resource and we remain committed to the ITU process and the goals of global harmonization. However, the United States had years ago determined that the **1930-1990** band would be used for PCS. That service succeeded beyond our greatest expectations. Although during this period the Commission had yet to issue **2** GHz satellite licenses because of continuing international allocation issues, it had established certain technical operating parameters. **As** we came closer to a decision in these proceedings, it became increasingly clear that there would be interference issues between the PCS providers at **1930-1990** and satellite operators above **1990.** The resulting interference may well have jeopardized the reliability and success of each service. Thus, although **I** highly value internationally harmonized operations, I determined that the ability of both services to operate reliably outweighed international concerns in this circumstance. Although **I** am disappointed that both interests could not be accommodated, I believe in the end stronger satellite and terrestrial services will result.

The decisions we reach today are significant and complex. The Commission's talented staff deserves credit and recognition **for** the long hours and tireless efforts that culminated in these orders' adoption. Together their efforts will allow for more efficient utilization of the, spectral resource, the development of innovative service offerings, and more diverse and competitive alternatives for consumers throughout the country.

SEPARATE STATEMENT OF
COMMISSIONER MICHAEL J. COPPS
Approving in Part, Dissenting in Part

Re: *In the Matter of Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands; IB Docket No. 01-185, IB Docket No. 02-364.*

I agree with today's decision to grant **MSS** licensees the authority to provide ancillary terrestrial service for their customers. The **MSS** industry is in its infancy. But it has great promise -- great promise to improve rural service, to enhance national security, and to strengthen the overall satellite infrastructure. It is with hope that ATC will further efforts to turn this promise into reality that I approve of the majority of today's order.

But it **is** also with the intention of maintaining the promise of the **2** GHz band, L-band, and big-LEO band that I support the strict gating requirements we insist on before ATC authority may be exercised. Satellite licensees must protect the vitality of satellite services in order to win ATC rights. This means operating their own satellite facilities, meeting tough construction and deployment milestones, providing "substantial satellite service," providing satellite-capable phones at point of sale, and either complying with the dual-mode-phone safe harbor or successfully demonstrating that another arrangement protects satellite service.

I must dissent on one point, however. The majority rejects the proposal contained in the NPRM to charge licensees fees for the additional spectrum usage rights we grant in this order. **MSS** licensees did not pay for their spectrum licenses at auction, since this is prohibited by Congress. **This** means that the public has not been compensated for this private use of public spectrum. Additionally, licensees who have not internalized the cost of purchasing spectrum licenses do not have the same incentive to use spectrum resources intensively. Charging **MSS** licensees a usage fee could mitigate these problems.

Questions about the fee's structure and FCC authority remain, even after the record on this proposal was received in response to the NPRM. I therefore would have made a tentative conclusion to impose such fees and would have initiated a second **NRPM** more specifically asking how to create a fee system, what authority the FCC has, and how fee amounts should be set. Doing so would have begun the process of insuring that the American people are adequately compensated for private use of a public resource, and that all spectrum users have the incentive to use spectrum intensively. While some in the majority believe this is "unproductive," I believe that working to find ways to promote the efficient **use** of spectrum and to compensate the public for the **use** of a public resource is our responsibility.

SEPARATE STATEMENT OF COMMISSIONER JONATHAN S. ADELSTEIN

Re: ***In the Matter of Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands; IB Docket No. 01-185, IB Docket No. 02-364.***

The issues addressed in today's Report and Order have been heavily debated before the Commission for almost two years, and I commend the staff for its hard work on this often contentious issue. I also commend the Chairman and my fellow Commissioners for their collective leadership on such a difficult and challenging matter. I am hopeful that today's decision facilitates the provision of mobile satellite services, particularly in those areas of the country, including rural areas, which currently are underserved by other wireless services.

I remain concerned, however, that our decision raises the possibility of unintended consequences – our decision should not allow a Mobile Satellite Services (MSS) system with an ancillary terrestrial component to evolve into a terrestrial system with an ancillary mobile satellite component. I thus write separately to underscore my commitment to ensuring that mobile satellite service licensees fully comply with the so-called "gating" restrictions prior to receiving ancillary terrestrial authority. I will pay particular attention to MSS licensees not presently operating systems to make certain that they satisfy the gating requirements by operating their own satellite facilities and providing substantial satellite service to the public prior to receiving authority to provide terrestrial services. I also intend to ensure that the restrictions are maintained throughout the grant of ancillary terrestnal authority by all MSS licensees.

Finally, I also share a keen interest in Congressional consideration of a grant of fee authority to the Commission.